Appendix B

Emission Calculations

Individual and combined heat input rate limits for the Gas turbines, HRSGs, and auxiliary boilers are given below in **Table B-1**. These are the basis of permit conditions limiting heat input rates.

Table B-1 Maximum Allowable Heat Input Rates

Source	MM BTU/hour-source	MM BTU/day-source	MM BTU/year-source
S-1 and S-3 Gas Turbines	1,990.5	47,772[a]	17,436,780[b]
S-1 CTG and S-2 HRSG S-3 CTG and S-4 HRSG	2,124[c]	49,908[d]	17,637,030[e]
All Sources Combined	4,268	99,816	35,274,060

[a]based upon specified maximum rated heat input of 1990.5 MM BTU/hr and 24 hour per day operation

[b]based upon 8,760 hours of operation at full load (1990.5 MM BTU/hr)

[c]maximum combined firing rate for gas turbine and HRSG duct burners

[d]based upon maximum duct burner firing of 16 hours per day; calculated as:

(16 hr/day)(2,124 MM BTU/hr) + (8 hr/day)(1,990.5 MM BTU/hr) = 49,908 MM BTU/day

[e]based upon maximum annual duct burner firing of 1,500 hr/year-HRSG; calculated as:

(1,500 hr/yr)(2,124 MM BTU/hr) + (7,260 hr/yr)(1,990.5 MM BTU/hr)
= 17,637,030 MM BTU/year

Table B-2 Maximum Annual Facility Emissions from Permitted Sources (ton/yr)

Source	NO_2	CO	POC	PM_{10}	SO_2
S-1 Gas Turbine and S-2 HRSG[a]	92.62	239.59	13.5	41.67	5.67
S-3 Gas Turbine and S-4 HRSG[a]	92.62	239.59	13.5	41.67	5.67
Total Permitted Emissions	**185.24[b]**	**587.18**	**27**	**83.34**	**10.58**

[a]includes gas turbine start-up and shutdown emissions

[b]applicant has proposed a reduced annual permit condition limit of 123.43 tons per year as mitigation

B-1.0 Gas Turbine Start-Up and Shutdown Emission Rate Calculations

The maximum nitrogen oxide, carbon monoxide, and precursor organic compound emission rates from a gas turbine occur during start-up and shutdown periods. The PM_{10}, sulfur dioxide, ammonia, and toxic compound emissions are a function of fuel use rate only and do not exceed typical full load emission rates during start-up.

Table B-3 Gas Turbine Start-Up Emission Rates (lb/start-up)

Pollutant	Cold Start-Up[a]	Hot Start-Up[b]
NO_x (as NO_2)	240	80
CO	2,514[c]	902
UHC (as CH_4)	48	16
PM_{10}[d]	27	9
SO_x (as SO_2)[e]	3.6	1.2

[a]cold start not to exceed three hours

[b]hot start not to exceed one hour

[c]based upon emission rate of 838 lb CO/hour per Sutter Power Project

[d]as a conservative estimate, based upon full load emission factor of 0.00452 lb PM_{10}/MM BTU and maximum heat input rate of 1,990.5 MM BTU/hr

[e]based upon full load emission factor of 0.0006 lb SO_2/MM BTU and maximum heat input rate of 1,990.5 MM BTU/hr

After considering source test data of Crockett Cogeneration gas turbine, it is assumed that turbine shutdown emission rates for NO_x, CO, and POC do not exceed full load emission rates. **Table B-4** is a comparison of baseload emission rates and shutdown emission rates based upon source test data.

Table B-4 Gas Turbine Shutdown Emission Rates (lb/hr)

Pollutant	Baseload Emission Rate	Crockett Cogeneration Source Tests[a]
NO_x	18	5.2
CO	43.84	29.5
UHC (as CH_4)	5	2.6

[a]G.E. Frame 7F turbine; testing of gas turbine shutdown emission rates occurred June 1997

Hot Start-Up Emission Rate Calculations

- Maximum duration: 1 hour

NITROGEN OXIDES (as NO_2)

NO_x emission rate: 80 lb/hr

NO_2 = (80 lb/hr)(1 hr/hot start)
= **80 lb/hot start**

CARBON MONOXIDE

CO emission rate: 902 lb/hr
(Sutter Power Plant emission rate from Westinghouse)

CO = (902 lb CO/hr)(1 hr/hot start)
= **902 lb/hot start**

PRECURSOR ORGANIC COMPOUNDS

POC emission rate: 16 lb/hr
(twice the full load turbine emission rate)

POC = (16 lb POC/hr)(1 hr/hot start)
= **16 lb/hot start**

PARTICULATE MATTER (as PM_{10})

- PM_{10} emissions are not increased during start-up
- PM_{10} emission factor based upon full load operation (emission rate of 9 lb/hr)

PM_{10} = (9 lb PM_{10}/hr)(1 hr/hot start)
= **9 lb PM_{10}/ hot start**

SULFUR DIOXIDE

- SO_2 emissions are not increased during start-up
- based upon full load emission factor of 0.0006 lb SO_2/MM BTU and maximum heat input of 1,990.5 MM BTU/hr

SO_2 = (0.0006 lb SO_2/MM BTU)(1,990.5 MM BTU/hr)(1 hr/hot start)
= **1.2 lb SO_2/hot start**

Cold Start-Up Emission Rate Calculations

- Maximum duration: 3 hours

NITROGEN OXIDES (as NO_2)

NO_x emission rate: 80 lb/hr

NO_2 = (80 lb/hr)(3 hr/cold start)
= **240 lb/cold start**

CARBON MONOXIDE

CO emission rate: 838 lb/hr
(Sutter Power Project estimate per Westinghouse)

CO = (838 lb/hr)(3 hr/cold start)
= **2,514 lb/cold start**

PRECURSOR ORGANIC COMPOUNDS

POC cold start emission rate: 16 lb/hr

POC = (16 lb POC/hr)(3 hr/cold start)
= **48 lb/cold start**

PARTICULATE MATTER (as PM_{10})

- PM_{10} emissions are not increased during start-up
- PM_{10} emission rate during start-up equals maximum baseload emission rate of 9 lb/hr

PM_{10} = (9 lb PM_{10}/hr)(3 hr/cold start)
= **27 lb PM_{10}/cold start**

SULFUR DIOXIDE

- SO_2 emissions are not increased during start-up
- based upon full load emission factor of 0.0006 lb SO_2/MM BTU and maximum heat input of 1,990.5 MM BTU/hr

SO_2 = (0.0006 lb SO_2/MM BTU)(1,990.5 MM BTU/hr)(3 hr/cold start)
= **3.6 lb SO_2/cold start**

B-2.0 Worst-Case Operating Scenarios and Regulated Air Pollutant Emissions for Gas Turbines and HRSGs

The Gas Turbine/HRSG emission rates shown in **Table B-5** are the basis of permit condition limits, emission offset requirements, and the PSD air quality impact analysis. To provide maximum operational flexibility, no limitations will be imposed on the type or quantity of turbine start-ups. Instead, the facility must comply with rolling consecutive twelve-month mass emission limits at all times. The mass emission limits are based upon the emission estimates calculated for the following power plant operating envelope.

- 6,844 hours of baseload (100% load) operation per year for each gas turbine
- 1,500 hours of duct burner firing per HRSG per year with steam injection power augmentation at gas turbine combustors
- 156 one-hour hot start-ups per gas turbine per year
- 52 three-hour cold start-ups per gas turbine per year

Table B-5 Maximum Annual Regulated Air Pollutant Emissions for Gas Turbines and HRSGs

Source (Operating Mode)	NO_2 (lb/yr)	CO (lb/yr)	POC (lb/yr)	PM_{10} (lb/yr)	SO_2 (lb/yr)
S-1 & S-3 Gas Turbines (520 total 1-hr hot start-ups)	41,600	469,040	8,320	4,680	624
S-1 & S-3 Gas Turbines (104 total 3-hr cold start-ups)	24,960	261,456	4,992	2,808	374.4
S-1 & S-3 Gas Turbines (13,688 total hours[a] @ 100% load)	246,384[b]	359,646.7[b]	34,220[b]	123,192	16,347.6
S-1 & S-3 Gas Turbines and S-2 & S-4 HRSGs (3,000 total hours[a] w/duct burner firing and steam injection power augmentation)	57,600[c]	84,210[c]	6,400[c]	36,000	3,823.2
Total Emissions (lb/yr)	370,484	1,174,352.7	53,932	166,680	21,169.2
(ton/yr)	**185.24[d]**	**587.18**	**27**	**83.34**	**10.58**

[a]total combined firing hours for both turbines

[b]based upon the maximum heat input rate of 1,990.5 MM BTU/hr for each gas turbine

[c]based upon the maximum combined heat input rate of 2,124 MM BTU/hr for each CTG/HRSG power train

[d]applicant has proposed a lower annual permit condition limit of 123.43 tons per year based upon an average NO_x emission concentration of 2.0 ppmvd @ 15% O_2 and an average number of start-ups per year

B-3.0 Fire Pump Diesel Engine Emissions

Table B-6 Regulated Air Pollutant Emissions for Fire Pump Diesel Engine

Pollutant	Emission Factor		Annual Emissions[a]
	g/bhp-hr	Lb/hr	lb/yr
Nitrogen Oxides (as NO_2)	5.89	3.90	390
Carbon Monoxide	3.55	2.35	235
Precursor Organic Compounds	0.73	0.48	48
Particulate Matter[b] (PM_{10})	0.25	0.17	17
Sulfur Dioxide	0.167	0.11	11

[a]based upon 100 hours of operation per year for exercising

[b]classified as a toxic air contaminant by the ARB

Table B-7
Worst-Case Toxic Air Contaminant Emissions for Fire Pump Diesel Engine

Toxic Air Contaminant	Emission Factor[a] (lb/MM BTU)	Annual Emissions[a] (lb/yr)
Benzene	9.33E-04	0.2
Toluene	4.09E-04	0.09
Xylenes	2.85E-04	0.06
Propylene	2.58E-03	0.54
1,3-Butadiene	3.91E-05	0.008
Formaldehyde	1.18E-03	0.25
Acetaldehyde	7.67E-04	0.2
Acrolein	9.25E-05	0.02
Total PAHs	1.68E-04	0.035

[a]based upon maximum fuel use rate of 2.11 MM BTU/hr and maximum 100 operating hours per year

B-4.0 Cooling Tower PM_{10} Emissions

The cooling tower is exempt from District permit requirements pursuant to Regulation 2-1-128.4. It is conservatively assumed that all particulate matter will be emitted as PM_{10}.

Cooling tower circulation rate:	133,378 gpm
Evaporation Rate:	3,704 gpm
maximum total dissolved solids:	5438 ppm
Drift Rate:	0.0005 %

Water mass flow rate:

(133,378 gal/min)(60 min/hr)(8.34 lb/gal) = 66,742,351.2 lb/hr

Cooling Tower Drift:

(66,742,351.2 lb/hr)(0.000005) = 333.7 lb/hr

PM_{10} = (5438 ppm)(333.7 lb/hr)/(10^6)
= 1.815 lb/hr
= 43.5 lb/day (24 hr/day operation)
= 15,896.4 lb/yr (8,760 operating hours per year)
= **7.95 ton/yr**

B-5.0 Worst-Case Toxic Air Contaminant (TAC) Emissions

The maximum toxic air contaminant emissions resulting from the combustion of natural gas at the S-1 & S-3 Gas Turbines and S-2 & S-4 HRSGs are summarized in **Table B-8**. These emission rates were used as input data for the health risk assessment modeling and are based upon a maximum annual heat input rate of 17,637,030 MM BTU per year (17,257 MM scf/yr based upon a fuel HHV of 1022 BTU/scf) for each gas turbine/HRSG pair. The derivation of the emission factors is detailed in Appendix A.

Table B-8
Worst-Case TAC Emissions for Gas Turbines and HRSGs

Toxic Air Contaminant	Emission Factor (lb/MM scf)	lb/yr[a]	g/sec
Acetaldehyde[c]	6.86E-02	1,183	1.70E-02
Acrolein	6.43E-03	111	1.59E-03
Ammonia[b]	6.7	115,622	3.27E00
Benzene[c]	1.36E-02	2,346	3.37E-03
1,3-Butadiene[c]	1.27E-04	2.2	3.15E-05
Ethylbenzene	1.79E-02	3,087	4.44E-03
Formaldehyde[c]	1.10E-01	1,897	2.73E-02
Hexane	2.59E-01	4,467	6.42E-02
Naphthalene	1.66E-03	28.6	4.12E-04
PAHs[c]	2.32E-03	40	5.75E-04
Propylene	7.70E-01	13,282	1.91E-01
Propylene Oxide[c]	4.78E-02	825	1.19E-02
Toluene	7.10E-02	1,225	1.76E-02
Xylene	2.61E-02	450	6.47E-03

[a]from each gas turbine/HRSG power train (S-1 & S-2 and S-3 & S-4)

[b]based upon the worst-case ammonia slip from the SCR system of 5 ppmvd @ 15% O_2

[c]carcinogenic compounds

The projected toxic air contaminant emissions from the exempt 10-cell cooling tower are summarized in **Table B-9**. The emissions are based upon an water circulation rate of 133,378 gpm and 8,760 hours of operation per year. As shown, the cooling tower does not trigger a risk screening analysis pursuant to District regulation 2-1-316.

Table B-9 Worst-Case TAC Emissions for 10-Cell Cooling Tower

Toxic Air Contaminant	Emission Factor (lb/hr)	Annual Emission Rate[a] (lb/yr)	Risk Screening Trigger Level (lb/yr)
Ammonia	1.83E-03	16	19,300
Arsenic[c]	2.33E-06	0.0204	0.024
Cadmium[c]	1.67E-06	0.015	0.046
Trivalent chromium[c]	1.00E-06	0.009	N/S[b]
Copper	7.00E-06	0.06	463
Lead[c]	1.83E-05	0.16	29
Mercury	1.50E-07	0.0013	57.9
Nickel	1.28E-05	0.11	0.73
Silver	1.67E-06	0.015	N/S[b]
Zinc	8.17E-05	0.72	6,760

[a]based upon 24 hr/day, 365 day/yr operation of 10-cell cooling tower at maximum flow rate

[b]none specified

[c]carcinogenic compound

B-6.0 Maximum Facility Emissions

The total permitted emission rates for the proposed gas turbines and HRSGs are shown in **Table B-10** and are the basis of permit condition limits and applicable emission offset requirements.

Table B-10 Maximum Annual Facility Regulated Air Pollutant Emissions (ton/yr)

Source	NO_2	CO	POC	PM_{10}	SO_2
S-1 CTG and S-2 HRSG[a]	92.62	293.59	13.5	41.67	5.67
S-3 CTG and S-4 HRSG[a]	92.62	293.59	13.5	41.67	5.67
Total Permitted Emissions[b]	**185.24**	**587.18**	**27**	**83.34**	**10.58**
10-Cell Cooling Tower[c]	0	0	0	7.95	0
Total Facility Emissions	**185.24[d]**	**587.18**	**27**	**91.29**	**10.58**

[a]includes gas turbine start-up and shutdown emissions

[b]permitted sources only; does not include emissions from exempt standby engines

[c]formerly exempt from BAAQMD permit requirements per Regulation 2-1-128.4; separate permit application pending

[d]applicant has proposed a lower annual permit condition limit of 123.43 tons per year

Table B-11
Maximum Hourly and Daily Regulated Air Pollutant Emission Rates for Baseload Operation
(Excluding Gas Turbine Start-up Emissions)

	NO_2	CO	POC	PM_{10}	SO_2
S-1 and S-3 Gas Turbines[a]					
lb/hr-source	18	26.3	2.5	9	1.2
lb/day-source	432	631.2	60	216	28.8
S-1 & S-2 and S-3 & S-4 Gas Turbine/HRSG Power Train[b]					
lb/hr-power train	19.2	28.07	2.7	12	1.28
lb/day-power train	451.2	659.5	63.3	288	30.72

[a]based upon maximum heat input rate of 1990.5 MM BTU/hr for each gas turbine

[b]Based upon a maximum combined heat input rate for each gas turbine/HRSG power train of 2,124 MM BTU/hr and maximum 16 hours per day duct burner firing

The maximum daily regulated air pollutant emissions per source including gas turbine start-up emissions are shown in **Table B-12**.

Table B-12
Maximum Daily Regulated Air Pollutant Emissions per Power Train (lb/day)

Source (operating mode)	NO_2	CO	POC	PM_{10}	SO_2
Gas Turbine (Cold Start-up)	240	2,514	48	27	3.6
Gas Turbine (Full load w/o Duct Burner Firing)	72	105.2	10	36	4.8
Gas Turbine & HRSG (Full load w/Duct Burner Firing and steam injection power augmentation)	307.2	449.1	43.2	144	20.5
Gas Turbine (Hot Start-up)	80	902	16	9	1.2
Total	**699.2**	**3,970.3**	**117.2**	**216**	**30.1**

[a]based upon one 1-hour hot start-up, one 3-hour cold start-up, 16 hours of full load operation with duct burner firing @ 2,124 MM BTU/hr with steam injection power augmentation, and 4 hours of full load operation without duct burner firing at 1990.5 MM BTU/hr over a 24 hour period. For example, CO emissions are calculated as follows:

(902 lb/hr)(1 hr/hot SU) + (838 lb/hr)(3 hr/cold SU) + (28.07 lb CO/hr)(16 hr/day) +
(26.3 lb CO/hr)(4 hr/day)
= 3,970.3 lb CO/day

Table B-13 summarizes the worst-case daily regulated air pollutant emissions from permitted sources. These are the basis of permit condition daily mass emission limits.

Table B-13
Worst-Case Daily Regulated Air Pollutant Facility Emissions from Permitted Sources (lb/day)

Source (Operating Mode)	NO_2	CO	POC	PM_{10}	SO_2
S-1 Gas Turbine (Cold Start-up)	240	2,514	48	27	3.6
S-1 Gas Turbine & S-2 HRSG (Full load w/Duct Burner Firing and steam injection power augmentation[a])	307.2	449.1	43.2	192	20.5
S-1 Gas Turbine (Full load w/o Duct Burner Firing[b])	72	105.2	10	36	4.8
S-1 Gas Turbine (Hot Start-up)	80	902	16	9	1.2
S-3 Gas Turbine (Cold Start-up[c])	240	2,514	48	27	3.6
S-3 Gas Turbine & S-4 HRSG (Full load w/Duct Burner Firing and steam injection power augmentation[a])	307.2	449.1	43.2	192	20.5
S-3 Gas Turbine (Full load w/o Duct Burner Firing[d])	36	52.6	5	18	2.4
S-3 Gas Turbine (Hot Start-up)	80	902	16	9	1.2
Total	**1,362.4**	**7,888**	**229.4**	**510**	**57.8**

[a]based upon 16 hours of operation at maximum combined heat input of 2,124 MM BTU/hr

[b]based upon 4 hours of operation at maximum heat input of 1,990.5 MM BTU/hr

[c]occurs at beginning of third hour of 24 hour period; assumes first turbine is in compliance with all emission limitations and out of start-up mode after two hours

[d]based upon 2 hours of operation at maximum heat input of 1,990.5 MM BTU/hr

B-7.0 Modeling Emission Rates

The NO_2 emission rates shown in **Table B-14** were used to model the air quality impacts of the MEC to determine compliance with State and Federal annual ambient air quality standards for NO_2. A screening impact analysis of gas turbine/HRSG duct burner emission rates and stack gas characteristics revealed that the worst-case annual average impacts for NO_2 occur under the following equipment operating scenario. To meet CEC requirements, the impact analysis included the NO_2 emissions from the exempt natural-gas-fired emergency generator and fire pump diesel engine.

Table B-14
NO_2 Emission Rates for Worst-Case Annual-Average Impacts

Source (Operating Mode)	NO_2		
	lb/yr	lb/hr	g/s
Gas Turbine (260 hot start-ups/turbine)	20,800		
Gas Turbine (52 cold start-ups/turbine)	12,480		
Gas Turbine (6,844 firing hours/turbine @ 1,990.5 MM BTU/hr)	122,986.7		
Gas Turbine and associated HRSG (1,500 hours/turbine w/duct burner firing @ 2,124 MM BTU/hr)	28,815		
S-1 CTG & S-2 HRSG Total Emissions	185,081.7	21.12	2.661
S-3 CTG & S-4 HRSG Total Emissions	185,081.7	21.12	2.661
Emergency Generator (200 firing hours/year)	354	0.0404	0.0051
Fire Pump Diesel Engine (200 firing hours/year)	780	0.09	0.0112

The PM_{10} and SO_2 emission rates shown in **Table B-15** were used to model air quality impacts and determine compliance with the State and Federal annual ambient air quality standards for PM_{10} and SO_2. Based upon a screening impact analysis of gas turbine/HRSG duct burner emission rates and stack gas characteristics, it was determined that the worst-case annual average impacts for PM_{10} and SO_2 occur under the equipment operating scenario shown below.

Table B-15
PM_{10} and SO_2 Emission Rates for Worst-Case Annual-Average Impacts

Source (Operating Mode)	PM_{10}			SO_2		
	lb/yr	lb/hr	g/s	lb/yr	lb/hr	g/s
S-1 Gas Turbine (7,260 hours @ 100% load)	72,709			8,712		
S-1 Gas Turbine & S-2 HRSG (1,500 hours w/duct burner firing @ 2,124 MM BTU/hr)	18,000			1,950		
S-1 & S-2 Total Emissions	90,709	10.35	1.304	10,662	1.217	0.153
S-3 Gas Turbine (7,260 hours @ 100% load)	72,709			8,712		
S-3 Gas Turbine & S-4 HRSG (1,500 hours w/duct burner firing @ 2,124 MM BTU/hr)	18,000			1,950		
S-3 & S-4 Total Emissions	90,709	10.35	1.304	10,662	1.217	0.153
Emergency Generator (200 firing hours/year)	0.8					
Fire Pump Diesel Engine (200 firing hours/year)	34	0.004	4.89E-04	22	0.0025	3.16E-04
10-Cell Cooling Tower	15,896.4	1.8	0.228	0	0	0

The PM_{10} and SO_2 emission rates shown in **Table B-16** were used to model air quality impacts and determine compliance with the state and federal 24-hour ambient air quality standards for PM_{10} and SO_2. Based upon a screening impact analysis of gas turbine/HRSG duct burner emission rates and stack gas characteristics, it was determined that the worst-case impacts for PM_{10} and SO_2 over a 24-hour averaging period occur under the equipment operating scenario shown below.

Table B-16
PM_{10} and SO_2 Emission Rates for Worst-Case 24-hour Average Impacts

Source (Operating Mode)	PM_{10}			SO_2		
	lb/day	lb/hr	g/s	lb/day	lb/hr	g/s
S-1 Gas Turbine & S-2 HRSG (Baseload Operation[a])	272	11.33	1.428	32.88	1.37	0.17
S-3 Gas Turbine & S-4 HRSG (Baseload Operation[a])	272	11.33	1.428	32.88	1.37	0.17
Emergency Generator[b]	1.12	0.0467	5.88E-03	0	0	0
Fire Pump Diesel Engine[b]	0	0	0	0.106	4.42E-03	5.56E-04
10-Cell Cooling Tower	43.2	1.8	0.228	0	0	0

[a]based upon 16 hours of operation at maximum combined heat input of 2,124 MM BTU/hr and 8 hours of gas turbine operation without duct burner firing at firing rate of 1,990.5 MM BTU/hr

[b]based upon 1 hour of full-load operation per 24-hour period; fire pump and generator will not operate within same 24-hour period

The carbon monoxide emission rates shown in **Table B-17** were used to model air quality impacts and determine compliance with the State and Federal 8-hour ambient air quality standards for CO. Based upon a screening impact analysis of gas turbine/HRSG duct burner emission rates and stack gas characteristics, it was determined that the worst-case impacts for CO over an 8-hour averaging period occur under the equipment operating scenario shown below.

Table B-17
CO Emission Rates for Worst-Case 8-hour Average Impacts

Source	CO		
(Operating Mode)	lb	lb/hr	g/s
S-1 Gas Turbine (3-hour Cold Start-up)	2,514		
S-1 Gas Turbine & S-2 HRSG (Full Load Operation w/Duct Burner Firing[a])	234		
Total:	2,748	343.5	43.27
S-3 Gas Turbine (3-hour Cold Start-up[b])	2,514		
S-3 Gas Turbine & S-4 HRSG (Full Load Operation w/Duct Burner Firing[c])	187		
Total:	2,701	337.6	42.53
Emergency Generator (1 hr of full-load operation per 8-hr period)	3	0.375	4.7E-02
Fire Pump Diesel Engine (not in operation)	0	0	0

[a]based upon 5 hours of operation @ 30^{o}F and maximum combined heat input of 2,124 MM BTU/hr

[b]commences at beginning of second hour of 8-hour period

[c]based upon 4 hours of operation @ 30^{o}F and maximum combined heat input of 2,124 MM BTU/hr

The NO_2, CO, and SO_2 emission rates shown in Table **B-18** were used to model air quality impacts and determine compliance with the State and Federal 1-hour ambient air quality standards for NO_2, CO, and SO_2. Based upon a screening impact analysis of gas turbine/HRSG duct burner emission rates and stack gas characteristics, it was determined that the worst-case impacts for CO and NO_2 over a 1-hour period occur when both turbines are operating at full load with duct burner firing at an ambient temperature of 90^oF. The emergency generator and fire pump will not be excercised on the same day. Therefore, the higher emission rate for each pollutant of the two engines is used for modeling.

Table B-18
NO_2, CO, and SO_2 Emission Rates for Worst-Case 1-hour Average Impacts

Source (Operating Mode)	NO_2		CO		SO_2	
	lb/hr	g/s	lb/hr	g/s	lb/hr	g/s
S-1 Gas Turbine & S-2 HRSG (Full Load Operation w/Duct Burner Firing and steam injection power augmentation[a])	19.21	2.42	46.73	5.89[b]	1.5	0.19
S-3 Gas Turbine & S-4 HRSG (Full Load Operation w/Duct Burner Firing and steam injection power augmentation[a])	19.21	2.42	46.73	5.89[b]	1.5	0.19
Emergency Generator	N/a	n/a	3.02	0.38	n/a	n/a
Fire Pump Diesel Engine	3.9	0.49	n/a	n/a	0.11	0.014

[a]based upon maximum combined heat input of 2,124 MM BTU/hr

[b]applicant used emission rate of 14.3 g/s (113.5 lb/hr) based upon original estimated CO emission concentration of 24.3 ppmvd

B-8.0 Maximum Facility Emissions During Commissioning Period

Table B-19 summarizes the worst-case 1-hour and 8-hour emission rates for the MEC during the commissioning period, when the SCR systems will not be installed and operational. These emission rates were used as inputs in air quality impact models that were used to determine if the MEC would contribute to an exceedance of the 1-hour State NO_2 ambient air quality standard, the 1-hour State and Federal CO standards, and the 8-hour State and Federal CO standards during the commissioning of the gas turbines, HRSGs, and related equipment. It is assumed that only one gas turbine will be commissioned at one time.

Table B-19
Worst-Case Short-Term NO_2 and CO Emissions from Gas Turbines during Commissioning Period

	NO_2		CO	
1-hour Emission Rates	lb/hr	g/s	lb/hr	g/s
S-1 Gas Turbine	362[a]	45.61	902[b]	113.7
S-3 Gas Turbine	362[a]	45.61	902[b]	113.7
8-hour Emission Rates[c]				
S-1 CTG & S-2 HRSG	N/A	N/A	343.5	43.28
S-3 CTG & S-4 HRSG	N/A	N/A	343.5	43.28

[a]based upon a conservative exhaust gas NO_x emission concentration of 50 ppmvd @ 15% O_2 for each turbine when operating without abatement by the SCR system; twice the turbine vendor unabated guaranteed emission rate of 25 ppmvd @ 15 % O_2

[b]equal to the turbine hot start-up CO hourly emission rate

[c]based upon one 3-hour cold start-up, followed by 5 hours of 100% load operation of CTG and HRSG at the maximum combined heat input rate of 2,124 MM BTU/hr; see Table B-17 for further detail